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Neuropsychological Functioning of Conduct Disorder Impacted by Age of Onset and Comorbid Attention-Deficit/Hyperactivity Disorder

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Neuropsychological Functioning of Conduct Disorder Impacted by Age of Onset and Comorbid Attention-Deficit/Hyperactivity Disorder

by

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Abstract

Neuropsychological Functioning of Conduct Disorder Impacted by Age of Onset and Comorbid Attention-Deficit/Hyperactivity Disorder

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Conduct Disorder is a disruptive behavior disorder listed in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision (DSM-IV-TR). Considering the prevalence and severity of Conduct Disorder and the social and economic impact, research is needed to address subtype and comorbidity. The purpose of the present study is to investigate the impact of Conduct Disorder age of onset by comparing neuropsychological functioning between adolescents diagnosed with Conduct Disorder, childhood-onset and adolescents diagnosed with the adolescent onset subtype of Conduct Disorder. In addition, the study will investigate the impact of a comorbid Attention-Deficit/Hyperactivity Disorder (ADHD) diagnosis. Exploration into the neuropsychological functioning of Conduct Disorder while considering comorbidity with

ADHD is needed to clarify cognitive functioning profiles of children and adolescents diagnosed with Conduct Disorder.

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INTRODUCTION

Conduct Disorder is a disruptive behavior disorder listed in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision (DSM-IV-TR). The disorder is characterized by a repetitive and persistent pattern of disruptive behavior which violates the basic rights of others or age-appropriate societal norms (American Psychiatric Association, 2000). The diagnostic criteria of Conduct Disorder are separated into four categories. These include aggressive conduct that threatens harm to people or animals such as bullying and fighting; destructive behavior that results in property loss or damage such as fire setting and property destruction; deceitfulness or theft behavior such as breaking and entering and stealing without direct confrontation of a victim; and serious rule violations such as running away from home and truancy. Conduct Disorder is divided into two subtypes depending upon the age of onset. Childhood-onset subtype includes children who begin demonstrating severe antisocial and aggressive behaviors prior to 10 years of age, while children who demonstrate severe conduct problems after 10 years of age comprise the adolescent-onset subtype.

The prevalence rate of Conduct Disorder for youth in America is estimated between 1% to 10% according to the American Psychiatric Association (2000). However, Conduct Disorder prevalence rate estimates can vary and depend upon the sample being studied (Mash & Wolfe, 2006). In the general population of approximately 70 million children and adolescents in the United States, it is estimated that 5.6 to 17.5 million youth, or 6 to 16% of boys and 2 to 9% of girls, demonstrate behavioral problems (Mash & Wolfe, 2006). According to Kessler, Berglund, Chiu, Demler, Heeringa, Hiripi, Jin, Pennell, Walters, Zaslavsky, & Zheng (2004), the lifetime prevalence of DSM-IV

Conduct Disorder is 9.5%, with rates being higher for males (12%) than females (7.1%), and the median age of onset for Conduct Disorder is 11.6 years.

Conduct Disorder continues to significantly impact society financially, at least in part because of the large percentage of diagnosed children and adolescents who receive mental health and behavior management services from local, community, private facilities, county and state agencies, and the juvenile justice system. Prior to adulthood, the economic impact for a juvenile who is incarcerated because of excessive societal rule violations can exceed $60,000 a year (Webster-Stratton & Dahl, 1995).

According to Kazdin (2001) approximately 80% of youth in the United States general population who demonstrate severe disruptive behaviors are also likely to meet criteria for a psychiatric disorder sometime in the future. Conduct Disorder is frequently comorbid with other psychiatric disorders (Beiderman, Newcorn, & Sprich, 1991; Connor, Ford, Albert, & Doerfler, 2007; Nock, Kazdin, Hiripi, & Kessler, 2006; Wozniak, Biederman, Faraone, Blier, Monuteaux, 2001). Connor et al. (2007) assessed children and adolescents and learned that those patients diagnosed with Conduct Disorder, childhood-onset had significantly higher rates of Attention Deficit/Hyperactivity Disorder and anxiety disorders. Patients with Conduct Disorder, adolescent-onset had significantly higher rates of Posttraumatic Stress Disorder, Substance Use Disorders, and cigarette use. The results were similar to findings by Nock, et al. (2006) who studied a nationally representative sample of adolescents and learned that Conduct Disorder is primary to diagnoses such as substance abuse and mood disorders, yet is secondary to impulse-control disorders and specific or social phobias.

Children and adolescents diagnosed with Conduct Disorder often demonstrate verbal deficits and perform significantly worse than controls on verbal intelligence measures (Pennington & Ozonoff, 1996). Many studies have been published on the

deficient verbal intelligence of children with Conduct Disorder, serious adolescent delinquents, and adult criminals (Lynam & Henry, 2001). For example, studies have found that delinquent adolescents consistently possess verbal deficits and their Performance IQ is often elevated over Verbal IQ (Aronowitz, Liebowitz, Hollander, Fazzini, Durlach-Misteli, Frenkel, Mosovich, Garfinkel, Saoud, DelBene, Cohen, Jaeger, & Rubin, 1994). According to Lynam and Henry (2001), poor verbal ability, as indexed by low Verbal IQ and other more specific neuropsychological measures, is associated with relatively severe and persistent conduct problems in childhood and adolescence.

In addition to the verbal deficits demonstrated by children and adolescents diagnosed with Conduct Disorder, research indicates that self-control or executive functioning deficits also exist (Lynam & Henry, 2001; Moffitt, 1993). Executive functioning is a term which describes a number of complex cognitive processes that are critical to purposeful, goal directed behavior (Lezak, Howieson, & Loring, 2004). Several authors have identified five key areas that comprise executive functioning. These important cognitive functions include response inhibition, cognitive flexibility, working memory, organization and planning, and fluency (Pennington and Ozonoff, 1996; Sergeant, Geurts, & Oosterlaan, 2002).

There is controversy concerning the evidence of deficits in executive functioning associated with Conduct Disorder when comorbid Attention Deficit/Hyperactivity Disorder (ADHD) is statistically controlled. Consistent deficits on executive functioning tasks have been identified in ADHD samples across various studies (Pennington & Ozonoff, 1996; Barkley, 1997). According to Goldstein and Jansen (2007), ADHD is a disorder of inadequate response inhibition. Some evidence suggests that children/adolescents diagnosed with Conduct Disorder do not demonstrate deficits in

executive functioning when comorbid ADHD has been controlled (Pennington & Ozonoff, 1996).

The profiles of children with Conduct Disorder are further complicated by the methodological problems found in many Conduct Disorder studies. Although there is wide agreement among researchers for the validity of a subtype distinction between childhood- and adolescent-onset forms of Conduct Disorder, many studies have failed to control for age of onset (Pennington & Ozonoff, 1996). The tendency to place childhood- and adolescent-onset groups together may complicate the explanatory nature of research findings because differences between the groups may not be considered. Additionally, much of the research has focused on juvenile delinquents. Despite the similarities between juvenile delinquents and adolescents diagnosed with Conduct Disorder, there are noteworthy distinctions between a diagnosis of Conduct Disorder and juvenile delinquency. Conduct Disorder is a mental disorder as defined by the DSM-IV-TR, and juvenile delinquency is a legal term. A single adjudication is all that is required for a legal designation of juvenile delinquency, while a diagnosis of Conduct Disorder is attributable to the accumulation of numerous antisocial acts during a period of time (Moffitt, 1993).

Considering the prevalence and severity of Conduct Disorder and the social and economic impact, research is needed to address subtype and comorbidity. Examining children and adolescents diagnosed with Conduct Disorder by subtype can help provide a better understanding of the unique symptoms and neuropsychological functioning which may lead to the development of specialized treatment interventions. Further exploration into the neuropsychological functioning of Conduct Disorder while considering comorbidity with ADHD is needed to clarify cognitive functioning profiles of children and adolescents diagnosed with Conduct Disorder.

INTEGRATED LITERATURE REVIEW

Conduct Disorder

A Conduct Disorder diagnosis is considered when a child or adolescent demonstrates three or more disruptive behaviors that are included in the four categories of disruptive behavior. The four categories include aggressive conduct that threatens harm to people or animals, destructive behavior that results in property loss or damage, deceitfulness or theft behavior, and serious rule violations. Symptoms must have occurred in the past year with at least one symptomatic behavior occurring in the past 6 months. Considering the psychosocial developmental stage of adolescence, many adolescents may demonstrate poor judgment and poor impulse control at times and engage in isolated incidents of childish mischief or adolescent rebelliousness. However, a diagnosis of Conduct Disorder emphasizes the distinction that the child or adolescent has been engaging in multiple antisocial behaviors that are often repetitive, persistent, dangerous, and harmful to others (Pennington & Ozonoff, 1996).

There are a variety of assessment methods utilized to identify children and adolescents who meet the criteria for Conduct Disorder. Multiple methods may include unstructured and structured interviews, behavior rating scales, and observational data from parents, child, and teachers (Loney & Lima, 2003). According to the DSM-IV-TR, Conduct Disorder is one of the most frequently diagnosed conditions in outpatient and inpatient mental health facilities for children and adolescents (American Psychiatric Association, 2000).

Recent research regarding public expenditures on youth with Conduct Disorder highlights the importance of prevention and early treatment for the disorder (Foster & Jones, 2005). Researchers examined a range of expenditures related to Conduct Disorder

among adolescents in four diverse urban communities in the United States. Expenditures on youth were examined across multiple public sectors, including mental health, general health, school, and juvenile justice. Public costs for youth with Conduct Disorder were substantially larger than for youth with closely related conditions, such as Oppositional Defiant Disorder and those youth who had demonstrated elevated levels of problem behaviors. The economic impact primarily involved costs related to crime, as well as educational, health, and social services expenditures. According Foster and Jones (2005), annual costs exceeded $14000 for the average youth diagnosed with Conduct Disorder. This figure was over six times the cost as compared to youth without conduct problems, but lower than economic impact estimates presented by Webster-Stratton and Dahl (1995).

ETIOLOGY OF CONDUCT DISORDER

Researchers have identified multiple and interrelated risk factors that may contribute to the etiology of Conduct Disorder. According to the DSM-IV-TR, there are many factors that may predispose a child to the development of Conduct Disorder (American Psychiatric Association, 2000). These factors can be divided into home environment (family), school environment, and biological factors of the child/adolescent (Liabo & Richardson, 2007). There are familial risk factors such as parental rejection or neglect, inconsistent childrearing practices with overly harsh or overly permissive discipline styles, lack of supervision, frequent changes of caregivers, large family size, marital conflict, and mental illness such as Antisocial Personality Disorder, Depressive Disorder, and Substance Abuse/Dependence (American Psychiatric Association, 2000). Environmental risk factors include low socioeconomic status (SES), peer rejection, delinquent peer group association/gang affiliation, neighborhood exposure to violence,

maltreatment, and physical or sexual abuse (Lahey, Van Hulle, Waldman, Rodgers, D'Onofrio, Pedlow, Rathouz, & Keenan, 2006; Moffitt, 1993b; Zahn-Waxler, Shirtcliff, & Marceau, 2008). Biological risk factors such as difficult temperament, neurological abnormalities, delayed motor development, intellectual ability, reading difficulties, hyperactivity, poor verbal skills, poor memory, and deficits in executive functioning may also increase the risk for Conduct Disorder (Moffitt, 2003; Talbott & Lee, 2005). Typically, these risk factors do not occur in isolation, but rather, it is the accumulation of family, social/environmental, and biological risk factors that interact in the development of conduct problems (Liabo & Richardson, 2007).

CONDUCT DISORDER SUBTYPES

According to the DSM-IV, Conduct Disorder is divided into two subtypes depending upon the age of onset (American Psychiatric Association, 2000). Childhood-onset subtype includes children who begin demonstrating severe antisocial and aggressive behaviors prior to 10 years of age, while children who demonstrate severe conduct problems after 10 years of age comprise the adolescent-onset subtype. The two subtypes differ in their etiology, course, and cognitive functioning leading to a general consensus among researchers for the validity of a subtype distinction between childhood- and adolescent-onset forms of Conduct Disorder (Pennington & Ozonoff, 1996).

The DSM-IV field trial sample led to the distinction between subtypes of Conduct Disorder and indicated that the two subtypes differ markedly in their level of physical aggression. Specifically, youth diagnosed with Conduct Disorder, childhood-onset were 8.7 times more likely to exhibit at least one aggressive behavior as compared to youth diagnosed with Conduct Disorder, adolescent-onset (Lahey, Loeber, Quay, Applegate, Shaffer, Waldman, Hart, McBurnett, Frick, Jensen, Dulcan, Canino, & Bird, 1998). In

addition, youth diagnosed with Conduct Disorder, childhood-onset subtype appear to be at greater risk for later maladjustment and persistent difficulties during their lifespan. These youth tend to demonstrate a number of dispositional risk factors such as difficult temperaments, impulsivity, low intelligence, and other cognitive deficits that exacerbate contextual factors (Hinshaw, 1994; Marsee, Frick, & Salkind, 2006; Moffitt, Lynam, & Silva, 1994). These deficits have a tendency to negatively impede social skill development and ultimately lead to what Moffitt (2003) calls, a life-course persistent pathway. Studies have suggested the life-course persistent path of antisocial behavior begins in childhood when dispositional risk factors interact with environmental risk factors such as inadequate parenting, disrupted family bonds, and poverty. The life-course persistent pathway theory predicts that interactions between the individual and their environment exacerbate problematic behaviors extending beyond the family and continuing into adult life. Research has supported the pathway distinction, and according to Liabo and Richardson (2007) early patterns of Conduct Disorder were particularly stable with half of the most antisocial boys ages 8 to 10 continuing to demonstrate antisocial behavior at age 14, and 43% continuing to demonstrate antisocial behavior at 18 years of age. In addition, researchers Hinshaw (1994) and Zoccolillo, Pickles, Quinton, and Rutter (1992) reported that over 80% of males who develop Conduct Disorder, childhood onset subtype continue to demonstrate multiple difficulties in social functioning characterized by disrupted friendships and intimate relationships as well as vocational problems.

In contrast, Conduct Disorder, adolescent-onset subtype begins during adolescence and has its origins in social processes. The conduct problems that emerge during adolescence are thought to be an exaggeration of the normal developmental processes of adolescent identity formation. These adolescents do not share the same

cluster of risk factors as childhood-onset youth, but these youth tend to demonstrate greater affiliation with delinquent peers and score higher on measures of rebelliousness and authority conflict (Marsee, et al., 2006).

CONDUCT DISORDER AND COMORBIDITY

Conduct Disorder alone creates difficulties for a child/adolescent, their family, schools, the community, treatment providers, and even the juvenile justice system. Moreover, Conduct Disorder is often comorbid with other conditions (Greene, Biederman, Zerwas, Monuteaux, Goring, & Faraone, 2002; Maughan, Rowe, Messer, Goodman, & Meltzer, 2004). Conduct Disorder is often associated with one or more of the following disorders: ADHD, Anxiety Disorders, Mood Disorders, and Substance-Related Disorders. Conduct Disorder is also often associated with Learning Disorders since academic achievement, particularly in reading and other verbal skills, is often below the expected level on the basis of age and intelligence (American Psychiatric Association, 2000).

CONDUCT DISORDER COMORBID WITH ADHD

Pihl, Vant, and Assaad (2003) reported that Conduct Disorder is commonly diagnosed with ADHD. As many as fifty to seventy-five percent of children diagnosed with Conduct Disorder also report the presence of ADHD symptoms (Kutcher, Aman, Brooks, Buitelaar, vanDaalen, Fegert, Findling, Fisman, Greenhill, Huss, Kusumakar, Pine, Taylor, & Tyano, 2004). Researchers have suggested that in some cases ADHD precedes the development of Conduct Disorder, and the ADHD components of impulsivity and hyperactivity are considered the driving forces responsible for the development of Conduct Disorder, childhood-onset.

ADHD is a psychological condition that can significantly impact social, familial, academic, and occupational functioning. Frequent and severe symptoms include inattention, hyperactivity, and impulsivity above and beyond what is typical for developmentally comparable peers (American Psychiatric Association, 2000). According to the DSM-IV-TR, data on the prevalence of ADHD in adolescents is limited, but has been estimated at 3 to 7% in school-age children equating to approximately 2 million children in the United States. Children and adolescents diagnosed with ADHD are usually identified during early school years because of behavior management problems in the classroom. Behavior disruptions often include fidgetiness, talking out of turn, difficulty completing school work, and difficulty with limits (Chhabildas, Pennington, & Willcutt, 2001).

Children and adolescents diagnosed with ADHD often experience low frustration tolerance, problems with emotion regulation, peer rejection, low self-esteem, and impaired academic achievement (American Psychiatric Association, 2000). Without proper and adequate intervention, ADHD symptoms may manifest into further psychological complications. ADHD difficulties often persist throughout a child's development and can lead to more severe emotional or behavioral difficulties such as those characterized by symptoms that meet the criteria for Oppositional Defiant Disorder and Conduct Disorder.

Children with ADHD display a greater degree of difficulty with oppositional and defiant behavior, aggressiveness and conduct problems, and even antisocial behavior (Barkley, 1990). The presence of ADHD usually signals a more severe form of Conduct Disorder with a chronic course and poor outcome (Connor, et al., 2007; Taylor, Chadwick, Hepinstall, & Danckaerts, 1996). Children diagnosed with both ADHD and Conduct Disorder typically have more negative outcomes compared to those children

diagnosed with Conduct Disorder alone. These children tend to experience more academic problems and peer rejection, demonstrate more episodes of physical aggression, and experience a greater range and persistence of antisocial behavior.

Additionally, children diagnosed with comorbid Conduct Disorder and ADHD are frequently in conflict with persons in their environment and possess a poor ability to modulate negative affect (Barkley, 1997). Accordingly, researchers have learned that children who were diagnosed with Conduct Disorder, childhood-onset and who had high rates of comorbid ADHD were significantly associated with self-reported hostile attributions (Connor, et al., 2007). As a result of misperceiving the intentions of others as hostile and threatening, these youth respond more readily with aggression and think that aggression is a reasonable and justified resolution to the perceived conflict (Connor, et al., 2007).

NEUROPSYCHOLOGICAL FUNCTIONING AND CONDUCT DISORDER

Neuropsychology is the study of brain-behavior relationships (Lezak, Howieson, & Loring, 2004; Mattison, Hooper, & Carlson, 2006). Research and assessment in this area seeks to understand how the brain produces and controls behavior and mental processes, including emotions, personality, thinking, learning, and problem solving. Cognitive and behavioral areas that are typically measured include sensory and motor skills, visual-spatial abilities, memory, verbal functions, language, concentration and attention, executive functioning, IQ and cognition, achievement, and emotional functioning (Lezak, et al. 2004).

Neuropsychological research with adolescents who display conduct problems and aggressive or violent behavior has produced a variety of inconsistent results (Golden & Golden, 2001; Teichner & Golden, 2000). Researchers have learned that a varied pattern

of neuropsychological deficits have been displayed across studies depending on the sampling method, methodological design, statistical procedures, control groups, and assessment instruments. Deficits in verbal abilities have occurred the most frequently across the literature, while evidence for deficits in executive functioning, visual-spatial ability, sensory, and motor skills have been inconsistent. Despite the various confounds in the literature, Teichner and Golden (2000) concluded that neuropsychological impairment plays a role in the etiology and maintenance of aggressive behavior in addition to the contributing impact of biological, psychological, sociocultural, and environmental risk factors to the development of aggressive and violent tendencies. Still, even in adults, where the majority of the research has been conducted, the specific manner in which neuropsychological variables interact with the individual and their environmental factors is still a matter of dispute and speculation (Teichner & Golden, 2000).

In an early review of the Conduct Disorder literature, Moffitt (1993) identified 47 published research studies dated between 1965 and 1992 that addressed the issue of neuropsychological functioning in adolescents with conduct problems and antisocial behavior. In all of the studies reviewed, the overwhelming evidence suggested juvenile delinquents were impaired in two specific cognitive domains. The impairments included language-based verbal skills and executive functions.

Verbal Functioning and Conduct Disorder

Moffitt (1993) deduced her conclusions about a specific deficit in language skills based upon participants' (juvenile delinquents) Performance IQ (PIQ) scores exceeding their Verbal IQ (VIQ) scores on the Wechsler IQ scales. VIQ scores are representative of language based processing skills with subtests that are administered orally and require an

oral response. Alternatively, Performance IQ subtests are language-free and do not require an oral response. Performance responses are administered and solved in the visual-spatial mode. In addition, Moffitt (1993) cited a large number of additional studies not included in her review that have revealed that PIQ scores often exceed VIQ scores in juvenile delinquents (Moffitt, 1993). These findings serve as strong support for a language deficit in children and adolescents displaying conduct problems and antisocial behavior.

Studies utilizing measures other than IQ tests to assess verbal abilities have also provided evidence for verbal deficits in adolescents engaging in antisocial behavior. In a more recent review of the literature, poor verbal ability as indexed by low VIQ and impaired verbal memory was often associated with relatively severe and persistent conduct problems in childhood and adolescence (Lynam and Henry, 2001). Research indicated adolescent delinquents demonstrated impaired auditory language skills and verbal memory deficits. Since language functions are localized in the left hemisphere in almost all individuals, the research review findings have also been interpreted as support for dysfunction of the left hemisphere (Lynam & Henry, 2001).

Verbal language deficits may lead to learning disabilities since these deficits are often accompanied by difficulties with problem solving, difficulty mediating verbal situations, and difficulty learning in academic settings. The association between delinquency and low educational achievement, in particular, low reading performance, has been consistently reported in the literature (Maguin, Loeber, & LaMahieu, 1993). It is hypothesized that poor reading performance and subsequent school failure often lead children and adolescents to feel frustrated, less attached to their school, and develop low self-esteem leading to an increased likelihood for delinquent peer association and disruptive behavior.

Mattison, et al., (2006) examined neuropsychological deficits associated with a sample of special education students who had complicated presentations of poor achievement and serious emotional/behavioral disorders. In this study, researchers learned that neuropsychological deficits in language and attention/executive functions were often related to the overt externalizing problems such as disobedience, fighting, destruction of property, and other behaviors that characterize the Aggressive Problem syndrome on the Child Behavior Checklist. Researchers suspected that language deficits may serve as a catalyst for aggressive behavior because of poor verbal skills and a misinterpretation of language and social cues. In addition, impulsivity or lack of self control, poor frustration tolerance, and low self-esteem may often accompany academic failure.

Executive Functioning and Conduct Disorder

Deficits in executive functioning appear to be another neuropsychological source of juvenile delinquents' difficult behavior. Sustaining attention and concentration, abstract reasoning, sequencing, strategy formation, set shifting, and planning are all cognitive processes which are often referred to as executive functioning. These executive functioning processes provide an individual with the ability to plan, initiate, maintain, and alter goal-directed behavior (Pihl, Vant, & Assaad, 2003). It has been associated with frontal lobe activity in the brain, and provides the necessary skills for purposeful, goal-directed behavior (Lezak, 1995). According to Eslinger (1996) there are various definitions of executive functioning reflecting the differing dimensions that are assessed. Several authors have identified five key areas that comprise the concept of executive functioning. These main cognitive functions include response inhibition, cognitive

flexibility, working memory, organization and planning, and fluency (Pennington and Ozonoff, 1996; Sergeant, et al., 2002).

Research has linked Conduct Disorder to executive functioning deficits (Moffitt, 1993). Persistent and impulsive behaviors characteristic of children and adolescents diagnosed with Conduct Disorder may be associated with executive deficits (Moffitt, 1993). Recent studies generally support the executive dysfunction hypothesis in aggressive antisocial individuals (Ishikawa & Raine, 2003; Hughes, White, Sharpen, & Dunn, 2000). Poorer executive functions have differentiated children with Conduct Disorder or aggressive children from nonaggressive controls (Seguin, Pihl, Harden, Tremblay, & Boulerice, 1995; Toupin, Dery, Pauze, Mercier, & Fortin, 2000).

Several studies have examined the relationship between executive functioning and conduct problems. Skoff and Libon (1987) compared incarcerated delinquent adolescents' performance on executive functioning tasks, including the Wisconsin Card Sort Test (WCST), the Porteus Mazes, Trails B, and Verbal Fluency. Results revealed significant executive function impairment for delinquents as compared to non-delinquents. Moffitt and Henry (1989) utilized the WCST, Verbal Fluency, Trails B, Porteus Mazes, and the Rey Osterreith Complex Figure Test (RCFT) to assess executive functioning of adolescent delinquents. Results indicated significant impairment in self-reported early delinquents as compared to non-delinquents even after the effects of IQ was statistically controlled (Lynam & Henry, 2001).

NEUROPSYCHOLOGICAL FUNCTIONING OF CONDUCT DISORDER BY SUBTYPE

There is some research suggesting that neuropsychological profiles may be able to distinguish between Conduct Disorder, childhood-onset and Conduct Disorder, adolescent-onset (Burke, Loeber, & Birmaher, 2002). Based on a sample of several

hundred New Zealand males ages 13 to 18, poor neuropsychological scores were associated only with childhood-onset of delinquency. Neuropsychological profiles were unrelated to delinquency that began in adolescence (Moffitt, Lynam, & Silva, 1994). In addition, research has revealed that only those adolescents with Conduct Disorder, childhood-onset exhibit verbal intelligence quotient (IQ) deficits, impulsivity, and attention problems with associated neurodevelopmental difficulties (Hinshaw, 1994; Moffitt, 1993; Moffitt, Lynam, & Silva, 1994). The adolescent-onset group lacked significant neuropsychological impairment, and their disruptive behaviors were thought to be due to peer group influences. According to the research, neuropsychological differences observed between healthy adolescents and adolescents diagnosed with Conduct Disorder are largely confined to those with the childhood-onset form of Conduct Disorder (Moffitt, 1993).

Vermeiren, De Clippele, Schwab-Stone, Ruchkin, and Deboutte (2002) were interested in learning if neuropsychological assessment can be utilized to predict persistent delinquency in adjudicated adolescents and offer treatment interventions. The researchers followed 63 adjudicated adolescents, ages 14-17, for two years to monitor recidivism rates. The researchers identified three groups of adjudicated adolescents based on recidivism rates and occurrences. Non-recidivists included 29 adolescents who had an initial adjudication only and no subsequent registered offenses during the two-year follow-up period. The 22 adolescents without early, officially registered offenses (before age 14) but with multiple offenses at follow-up were identified as late recidivists. Lastly, the 12 adolescents with early offenses (before age 14) and additional offenses at follow-up were identified as early recidivists.

The three groups of adjudicated adolescents were compared by conducting multiple neuropsychological tests including the Wechsler Intelligence Scale for Children

– Revised (WISC-R) or Wechsler Adult Intelligence Scale (WAIS), Rey Auditory Verbal Learning Test (AVLT), Bourdon-Vos Test, Gibson Spiral Maze, and the Wisconsin Card Sorting Test (WCST). The assessment instruments assessed each adolescent's intelligence, short- and long-term memory for verbal material, concentration and attention, psychomotor performance, impulsivity, planning, and the ability to shift in alternating sequencing strategies, respectively. The researchers hypothesized that delinquent adolescents, especially those identified as early recidivists, would demonstrate lower IQ scores, specifically on verbal tests, and greater deficits in self control such as impulsiveness and concentration, whereas late recidivists would not demonstrate these types of deficits (Vermeiren, et al., 2002).

Researchers learned that when compared to non-recidivists adolescents, the early recidivist adolescents had lower overall IQ, verbal IQ, performance IQ, and they also demonstrated a number of deficits in memory and self-control. In addition, the researchers learned that late recidivists demonstrated lower verbal IQ as compared to non-recidivists adolescents, whereas early recidivist adolescents demonstrated lower total IQ, verbal IQ, freedom from distractibility, and long-term memory as compared to late recidivist adolescents. The findings corresponded with Moffitt's (1997) review of the literature indicating that youth diagnosed with Conduct Disorder, childhood-onset demonstrated greater impairments in cognitive function, language abilities, poor memory, and impulsiveness. The findings also considered the influence of substance abuse and statistical analyses indicated that the level of substance abuse did not alter the results, suggesting that the effects of substance abuse was not a unique explanation for the neuropsychological differences in the delinquent adolescents (Vermeiren et al., 2002).

NEUROPSYCHOLOGICAL FUNCTIONING AND ADHD

There is strong evidence linking ADHD to executive functioning deficits (Chhabildas, et al., 2001; Barkley, 1997; Nigg, 2000). According to Barkley (2000), ADHD is a problem with the stimulus control or regulation of behavioral responses, particularly in the area of behavioral inhibition. According to Willcutt, Pennington, Olson, Chhabildas, and Hulslander (2005), children diagnosed with ADHD perform poorly on tasks that assess verbal working memory and processing speed, in addition to weaknesses on measures of response inhibition. Accordingly, a child diagnosed with ADHD who has deficits in the areas of response inhibition or self-regulation may have difficulty waiting his or her turn or may interrupt or intrude on others. Children and adolescents diagnosed with ADHD who have trouble organizing and planning may exhibit poor academic achievement. In addition, children are often required to retain information from past experiences in order to better problem solve in the future. If there are working memory deficits, as in children with ADHD, learning may be extremely difficult (Baron, 2004). Children who experience difficulties learning because of ADHD complications may be more vulnerable to academic failure because of poor achievement and performance.

NEUROPSYCHOLOGICAL FUNCTIONING OF ADHD BY SUBTYPE

The DSM-IV-TR identifies three subtypes of ADHD which include ADHD, Predominantly Inattentive Type (ADHD-IA), ADHD, Predominantly Hyperactive-Impulsive Type (ADHD-HI), and ADHD, Combined Type (ADHD-CT). Although most individuals present with symptoms of both inattention and hyperactivity, some individuals may present with a predominant symptom pattern, whether it be predominantly inattentive, predominantly hyperactive, or a combination of the two.

Researchers have focused on the identification of an ADHD neuropsychological profile and the identification of neuropsychological functions of the ADHD subtypes. According to Barkley (1997) individuals diagnosed with ADHD-HI and ADHD-CT exhibit problems maintaining attention that result from deficits in behavioral inhibition. Individuals diagnosed with ADHD-IA exhibit problems maintaining attention that arise from noninhibitory mechanisms. Still, other researchers have reported that symptoms of inattention are most associated with neuropsychological impairment across both the ADHD-CT and ADHD-IA subtypes (Hinshaw, 1994; Marsee, et al., 2006; Moffitt, 1993). Therefore, children and adolescents diagnosed with combined type and predominantly inattentive type are often impaired in areas requiring attention, processing speed, alertness, and working memory (Hinshaw, 1994; Marsee, et al., 2006; Moffitt, 1993).

NEUROPSYCHOLOGICAL FUNCTIONING OF CONDUCT DISORDER COMORBID WITH ADHD

Aronowitz, Liebowitz, Hollander, Fazzini, Durlach-Misteli, Frenkel, Mosovich, Garfinkel, Saoud, DelBene, Cohen, Jaeger, and Rubin (1994) were interested in identifying the neurological and neuropsychological deficits attributable to Conduct Disorder, ADHD, and their comorbidity. The researchers conducted a pilot study with twenty adolescent patients diagnosed with Conduct Disorder, ADHD, and/or Oppositional Defiant Disorder (ODD) who were hospitalized in a psychiatric facility. Researchers administered a comprehensive neuropsychological battery which included Wechsler Intelligence Scale for Children-Revised (WISC-R), Wisconsin Card Sorting Test (WCST), Trail Making Test (TMT), Matching Familiar Figures Test (MFFT), Neimark Memorization Strategies Test (NMST), and the Rey-Osterrieth Complex Figure Test (RCFT). The assessment instruments assessed each subjects' verbal abstraction,

vocabulary, visuoperceptual and visuoconstructional abilities (WISC-R), frontal executive functioning and mental flexibility (WCST and TMT), impulsivity (MFFT), memory and organizational capacity (NMST), and immediate recall, visual organization, and visual recall (RCFT).

Researchers performed three comparisons which included Conduct Disorder and ADHD versus Conduct Disorder, ADHD versus Non-ADHD, and Conduct Disorder versus Non-Conduct Disorder by conducting multiple uncorrected t-test comparisons. Researchers learned that subjects with Conduct Disorder and ADHD had a significantly greater number of left-sided neurological soft signs (e.g. poor motor coordination, sensory perceptual difficulties and difficulties in sequencing of complex motor tasks) than the Conduct Disorder only group. In addition, researchers learned that subjects with Conduct Disorder comorbid with ADHD were more impaired than Conduct Disorder only on neuropsychological measures of organization and executive function. When the Conduct Disorder group was compared to the non-Conduct Disorder group, researchers learned that the Conduct Disorder subjects displayed greater visuoperceptual and visuospatial difficulties.

Researchers also reported their results did not support previous literature findings of a deficit in language based verbal skills in adolescents diagnosed with Conduct Disorder. The results indicated neuropsychological differences between adolescent inpatients diagnosed with Conduct Disorder comorbid with ADHD as compared to adolescent inpatients diagnosed with Conduct Disorder only; however, a small sample size and increased chances for Type I error may warrant caution during results interpretation. In addition, the absence of a significant number of patients diagnosed with only ADHD prevented direct group comparisons between Conduct Disorder and ADHD (Aronowitz, et al., 1994).

Clark, Prior, and Kinsella (2000) were also interested in determining if executive functioning deficits were specific to ADHD when compared to conduct disorders. The researchers compared four groups of adolescents from a community sample which included individuals diagnosed with only ADHD, those diagnosed with Oppositional Defiant Disorder (ODD) or Conduct Disorder, those diagnosed with ADHD comorbid with ODD or Conduct Disorder, and a nonclinical comparison group. All participants were between the ages of 12 and 15, and each participant was administered two neuropsychological measures of executive functions, including the Six Elements Tests (SET) and the Hayling Sentence Completion Test (HSCT).

Researchers learned that adolescents diagnosed with ADHD only and adolescents diagnosed with ADHD comorbid with ODD/Conduct Disorder performed significantly worse on executive function tasks as compared to participants without ADHD and those diagnosed only with ODD or Conduct Disorder. The adolescents diagnosed with ADHD and adolescents diagnosed with comorbid ADHD and ODD/Conduct Disorder were significantly more impaired in their ability to generate cognitive strategies and to monitor their ongoing behavior compared with an age-matched adolescent control group and the ODD/ Conduct Disorder group. Researchers concluded that executive function deficits, as assessed by the SET and the HSCT, were specific to ADHD (Clark, et al., 2000).

However, only 24% of the adolescents in the research study met the diagnostic criteria for Conduct Disorder while 76% met the criteria for ODD which limits the generalizability of the study. The severity of symptoms associated with ODD are typically less severe as compared to symptoms defining Conduct Disorder. As a result, it may be possible that adolescents diagnosed with ODD may demonstrate fewer executive functioning deficits as compared to adolescents diagnosed with Conduct Disorder.

Adolescents diagnosed with Conduct Disorder comorbid with ADHD have demonstrated deficits in executive functioning (Moffitt, 1993; Speltz, DeKlyen, Calderon, Greenberg, & Fisher, 1999), but additional research has identified discrepant findings of deficient verbal functioning in delinquent populations (Aronowitz, et al, 1994). Therefore, more empirical studies are needed to understand the severity of impact upon neuropsychological functioning of Conduct Disorder when comorbid with ADHD.

Summary and Rationale for Proposed Study

Moffitt (1993) reviewed 47 published research studies comparing neuropsychological deficits of adolescents labeled as delinquent; however, only one published neuropsychological study included adolescents with a clinical diagnosis of Conduct Disorder (Frost, Moffitt, & McGee, 1989). Even though children and adolescents who engage in delinquent behavior may develop or meet the criteria for Conduct Disorder, juvenile delinquency is a social term and not a diagnosis. Therefore, not all children or adolescents who offend are conduct disordered (Liabo & Richardson, 2007). Moffitt (1993) stressed the importance of future research on children and adolescents diagnosed with Conduct Disorder. Moffitt (1990) also reported delinquent adolescents diagnosed with ADHD had significantly lower Verbal IQ scores and greater executive function deficits as compared to delinquent adolescents without a comorbid diagnosis of ADHD. Adolescents diagnosed with comorbid ADHD had the earliest onset of delinquency and the most violent and resistant course. In addition, deficits in cognitive functioning as evidenced by intelligence testing (IQ) have been repeatedly linked to disruptive behavior disorders such as ODD and Conduct Disorder, yet a review by Hogan (1999) found that when comorbid ADHD diagnoses were statistically controlled for

during the research, the Conduct Disorder and intelligence quotient (IQ) relationship was often found to be non-significant.

Children diagnosed with Conduct Disorder, Childhood-Onset type tend to demonstrate a number of dispositional risk factors such as difficult temperaments, impulsivity, low intelligence, and other cognitive deficits that exacerbate contextual factors. These deficits may negatively impede social skill development and lead to a greater risk for later maladjustment and even the development of antisocial personality disorder as an adult (Hinshaw, 1994; Marsee, et al., 2006; Moffitt, 1993). Many children diagnosed with the Conduct Disorder, childhood-onset may be diagnosed with ADHD. Over 80% of males who develop Conduct Disorder, childhood-onset continue to demonstrate multiple difficulties in social functioning characterized by disrupted friendships, intimate relationship difficulties, and vocational problems (Hinshaw, 1994; Zoccolillo, et al., 1992). In contrast, conduct problems emerging during adolescence are thought to be an exaggeration of the normal developmental process of adolescent identity formation. These adolescents tend to demonstrate greater affiliation with delinquent peers and score higher on measures of rebelliousness and authority conflict (Marsee, et al., 2006). The adolescent onset subtypes do not share the same cluster of risk factors as childhood-onset youth (Hinshaw, 1994; Moffitt & Lynam, 1994). Furthermore, neuropsychological research with adolescents who display conduct problems has produced a variety of inconsistent results (Golden & Golden, 2001). Some studies have identified clear evidence of verbal deficits, others have identified deficits in executive functioning, and yet other researchers have identified no neuropsychological impairment. Considering the significantly different risk outcomes projected for adolescents diagnosed with different Conduct Disorder subtypes and inconsistent research findings, empirical studies are needed to investigate neuropsychological functioning between the two

subtypes of Conduct Disorder. What neuropsychological differences exist between adolescents diagnosed with Conduct Disorder, childhood-onset and adolescents diagnosed with Conduct Disorder, adolescent-onset subtype?

Considering the suggested detrimental impact of Conduct Disorder comorbid with ADHD, empirical studies are needed to further investigate neuropsychological functioning between adolescents diagnosed with both Conduct Disorder and ADHD as compared to adolescents diagnosed with Conduct Disorder without a comorbid diagnosis of ADHD. What neuropsychological differences exist between adolescents diagnosed with both Conduct Disorder and ADHD as compared to adolescents diagnosed with Conduct Disorder without comorbid ADHD?

PROPOSED RESEARCH STUDY

Statement of Purpose

The purpose of the present study is to investigate the impact of Conduct Disorder age of onset as evidenced by comparing neuropsychological functioning between adolescents diagnosed with Conduct Disorder, childhood-onset and adolescents diagnosed with Conduct Disorder, adolescent-onset. In addition, the study will also investigate the impact of Conduct Disorder comorbid with Attention Deficit Hyperactivity Disorder as evidenced by comparing neuropsychological functioning of adolescents hospitalized in a residential treatment facility.

Significance of the Research Study

The present study is important because treatment interventions with children and adolescents diagnosed with Conduct Disorder may need to be tailored to their specific neuropsychological deficits and needs. If the results from the present study demonstrate significant neuropsychological differences between the two subtypes of Conduct Disorder, specialized interventions may be warranted to assist adolescents in learning intervention techniques. In addition, if the present study demonstrates significant neuropsychological deficits between adolescents diagnosed with Conduct Disorder as compared to adolescents diagnosed with both Conduct Disorder and ADHD, specialized different treatment interventions may also be warranted. Considering the results from the present study, treatment providers may be better informed of needed alternative interventions designed to develop neuropsychological functioning in certain brain areas. From a treatment intervention perspective, increased understanding of their clients' neuropsychological strengths and weaknesses may lead to more empathy, patience,

understanding, and fewer incidences of compassion fatigue. Creating effective, specialized treatment interventions is crucial since research has demonstrated adolescents diagnosed with both Conduct Disorder and ADHD often exhibit greater risk for self-destructive behavior choices. Poor impulse control, poor judgment, poor self regulation skills, and reactive aggression and violence often associated with Conduct Disorder and ADHD can lead to a future that may create community dangers for others and result in incarceration for the adolescent.

Method

PARTICIPANTS

The research study will analyze archival data from patient files at San Marcos Treatment Center in San Marcos, Texas. San Marcos Treatment Center is a residential treatment facility located in southeast Texas providing long-term residential treatment for adolescents, ages 11 through 17 who require residential treatment for multiple psychiatric disorders, physical and sexual abuse, substance abuse/chemical dependency, and neurodevelopmental disorders.

Research data will be selected based on the patients' admission assessment results. The cases will be selected based on the following criteria: (a) neuropsychological and psychological assessments performed on adolescents between 13 years and 16 years, 11 months of age; and (b) adolescents who meet the criteria for one of five diagnostic categories: Conduct Disorder, childhood-onset subtype; Conduct Disorder, childhood-onset subtype plus Attention Deficit/Hyperactivity Disorder (ADHD); Conduct Disorder, adolescent-onset subtype; Conduct Disorder, adolescent-onset subtype plus ADHD; and ADHD only. A licensed psychologist and a board certified neuropsychologist will have provided a five axis diagnosis on all adolescent patients selected for the study. All

diagnoses were based upon criteria for the specific disorder in the DSM-IV-TR (American Psychiatric Association, 2000). Exclusionary criteria for case selection from the research study will consist of a Full Scale IQ (FSIQ) less than 75 as measured on the Wechsler Abbreviated Scale of Intelligence (WASI), chronic physical illness, or the presence of any comorbid Axis I or Axis II disorders. The researcher will review medical records and previous psychological assessments in order to categorize documented history and symptoms. If the case record reveals a diagnosis of Conduct Disorder without specifying the subtype, the researcher will assign the case to the Conduct Disorder, childhood-onset group if at least one symptom and functional impairment was identified in the clinical history prior to 10 years of age, or if the patient met full criteria for Oppositional Defiant Disorder before 10 years of age and developed a subsequent diagnosis of Conduct Disorder.

PROCEDURES

The study will comply with all ethical issues and standards of research set forth by the American Psychological Association and the University of Texas at Austin. A research study proposal will be submitted to the Departmental Review Committee within the Department of Educational Psychology and the Institutional Review Board of the University of Texas at Austin. The researcher will obtain approval from the custodian of the data, and will collect data post hoc by reviewing case records. In order to maintain confidentiality, the researcher will eliminate all identifying information including (a) names (b) social security number; (c) address; (d) telephone/fax number; (e) email address; and (f) health insurance information. A separate file number will be assigned to each case prior to transferring all data to a secure file.

All patients were administered the following measures by a licensed neuropsychologist or by doctoral students who were properly trained to administer each measure as a condition of their enrollment in a neuropsychology practicum course (Table 1). The measures were administered as part of a neuropsychological evaluation conducted upon admission into residential treatment. Administration of the entire battery was standardized with measures given in a specific order to account for delay times associated with verbal and visual memory tests. Testing lasted approximately 4 to 6 hours and typically occurred during one session with breaks as needed. Patients who were taking psychostimulant medication were asked to withhold medication for 24 hours prior to the testing session to minimize the influence of the medication intervention on the results.

Table 1: Neuropsychological Assessment Battery

Task	Test
Nonverbal Intelligence	Wechsler Abbreviated Scale of Intelligence (WASI), Performance IQ
Verbal Intelligence/ Language	Wechsler Abbreviated Scale of Intelligence (WASI), Verbal IQ
Academic Achievement	Wechsler Individual Achievement Test—Second Edition - Abbreviated (WIAT-II-A) Subtests: Word Reading, Numerical Operations, and Spelling
Executive Function	Children's Category Test (CCT)

Table 1 (continued)

Attention	Trail Making Test (TMT)
Verbal Memory	California Verbal Learning Test – Children's Version (CVLT-C), Total Recall List A (Trials 1-5) and Recognition Hits
Visual-Spatial Constructional Ability	Rey Complex Figure Test (RCFT), Copy Task
Motor Function	Grooved Pegboard

NEUROPSYCHOLOGICAL INSTRUMENTS

Intelligence

Wechsler Abbreviated Scale of Intelligence (WASI; The Psychological Corporation, 1999).

The WASI was administered to all patients to assess overall cognitive functioning. The test takes approximately 30 minutes to administer, covers ages 6 to 89, and assesses both verbal and nonverbal abilities. It consists of four subtests which include Vocabulary, Block Design, Similarities, and Matrix Reasoning. The four subtests yield an estimated Full-Scale IQ (FSIQ) score. The Vocabulary and Similarities subtests comprise the verbal scale and yield a Verbal IQ (VIQ) score, and the Block Design and Matrix Reasoning subtests comprise the performance scale and yield a Performance IQ (PIQ) score. An average standard score for the FSIQ, VIQ, and PIQ ranges from 85 to 115 (The Psychological Corporation, 1999). For the purposes of the present research, the VIQ score will be serve as a measure of verbal language ability and the PIQ score will serve as a measure of nonverbal cognitive ability.

The WASI was normed on a nationally representative sample of 2245 people, divided into 23 age groups ranging from age 6 to 89 years (Ns of 75–100 in each age group), and stratified according to recent U.S. Census data on three background variables of gender, race/ethnicity, and educational level. With children, internal consistency estimates range from .87 to .92 for each of the subtests. For the IQ scales, coefficients are .93, .94, and .86 for the VIQ, PIQ, and FSIQ, respectively. Test-retest reliability was evaluated by administering the WASI twice to 222 children and adults aged 6 to 89. The interval between tests ranged from 2 to 12 weeks, with a mean of 31 days. Stability coefficients for the FSIQ were .93 for children and .92 for adults. The subtest T scores of the second testing are about 0.8 to 4.6 points higher for the children's sample and about 0.6 to 2.8 points higher for the adult sample. Practice effects emerge following such short retest periods, and score increases are the highest for Block Design and the lowest for Vocabulary, regardless of age group. Similarly, the IQ scores from the second testing increased about 2.6 to 5.8 points for the children's sample and about 1.8 to 3.9 points for the adult sample, with the increases in PIQ higher than the increases in VIQ. Similar findings occur with the full form versions. Validity for the WASI was established through correlations with other intelligence tests which were moderately high ranging from .66 to .88 for subtests and .76 to .92 for the IQ scales (The Psychological Corporation, 1999). Interscorer agreement is reported to be high (.90) for both the verbal and nonverbal subtests (Strauss, Sherman, & Spreen, 2006).

Achievement

Although achievement tests are primarily utilized to assist in diagnosing learning disorders, they are also useful in evaluating aspects of expressive and receptive language, detecting individual strengths and deficits in patients with neurological disorders, and

estimating the functional skills of patients to determine the degree of assistance they will need in their daily lives (Strauss, et al., 2006). For example, when used in conjunction with other tests (e.g., executive functioning testing, adaptive behavior scales), achievement tests provide useful information that is relevant to many work and life situations (e.g., reading level, handling financial matters; Strauss, et al., 2006).

Wechsler Individual Achievement Test—Second Edition - Abbreviated (WIAT-II-A; The Psychological Corporation, 2001)

The WIAT-II-A is a brief, individually administered achievement test battery comprised of three subtests that reflect a thorough sampling of the relevant academic domains in reading, math, and written language skills. The subtests include Word Reading, Numerical Operations, and Spelling. The WIAT-II-A can be administered to individuals 6 to 85 years of age in a relatively short period of time (The Psychological Corporation, 2001). Normative data was collected during the 1999-2000 and 2000-2001 school years and involved a total of 5,586 individuals across the U.S. Students with disabilities were included in the standardization sample (Strauss, et al., 2006).

Internal consistency and stability indicated generally strong inter-item consistency for the subtests (range = .71 to .99, with most coefficients at .90 or higher). Test-retest coefficients indicate adequate stability (corrected values .91 to .99) for three different age bands of the student sample (N = 352) and for a subgroup of the college and adult sample (N = 77) (Strauss, et al., 2006). Content validity was addressed by a thorough process of outlining the scope of each subtest with input from many sources and utilizing item analysis and item-bias techniques in order to retain the most effective items and to delete problematic items. Construct validity was examined through analysis of subtest intercorrelations that indicate that the Reading and Spelling scores are more highly correlated with each other than either is correlated with the Math scores. Correlations of

the WIAT-II-A subtest scores and the Wechsler IQ scores indicate that although there is a positive relationship between the two instruments, different skills are being measured. Criterion-related validity data for the WIAT-II-A was derived from a variety of small group studies that examine the relationship among these three subtests and the subtests of other individual and group achievement tests. Many of the correlations reported are in the moderate range (.78-.88) (Strauss, et al., 2006).

Executive Function and Attention

The Children's Category Test and the Trail Making Test (TMT) were utilized as neuropsychological tests of executive function and attention. These tests are commonly used clinical measures typically classified as executive in nature (Arffa, 2007).

Children's Category Test (Boll, 1993)

The Children's Category Test (CCT) is an individually administered measure designed to assess nonverbal learning and memory, concept formation, and problem-solving abilities. The CCT provides information on a child's ability to change problem-solving strategies, develop alternate solutions, and profit from previous experience. It consists of two levels: Level 1 is administered to children ages 5 to 8 years and consists of five subtests and 80 items, and Level 2 is administered to children and adolescents ages 9 to 16 years and consists of six subtests and 83 items. Each subtest is organized on the basis of a different principle, such as number of objects or spatial position of an odd stimulus. The test requires the deduction of a classification principle by means of response-contingent feedback, the use of the principle while it remains effective, and the ability to abandon the principle when it is no longer effective. Administration of the CCT takes approximately 15-20 minutes, and scoring consists primarily of counting and

summing the number of errors across the subtests for each level. T scores are computed based on the total number of errors across all subtests (Strauss, et al., 2006).

Reliability was estimated using the Spearman-Brown formula, with estimates ranging from .87 to .91 for Level 1 and from .81 to .89 for Level 2. The standard error of measurement varied by age ranging from 3.00 to 3.74 for Level 1 and 3.32 to 4.36 for Level 2. Test-retest reliability was reported by age group and varied from .70 to .79. Validity of the CCT was examined by construct. Construct validity information was obtained by investigating the relationship between the CCT and the Wechsler Intelligence Scale for Children--Revised (WISC-R) Vocabulary Subtest, the Wechsler Intelligence Scale for Children--Third Edition (WISC-III), and the California Verbal Learning Test--Children's Version (CVLT-C). Correlations between the CCT and the WISC-III ranged from .14 to .27. Correlations between the CCT and the CVLT-C ranged from .10 to -.37 for Level 1 and Level 2 (Strauss, et al, 2006).

Vacc (2004) recommends the CCT be used as part of a battery of instruments when doing a comprehensive assessment of a child as it may be helpful in obtaining a multidimensional, integrated understanding of a child's learning.

Trail Making Test (TMT; Reitan & Wolfson, 1955)

The Trail Making Test is a measure of attention, processing speed, and mental flexibility. Standard procedure requires the subject to connect, by making pencil lines, encircled numbers randomly arranged on a page in proper order (Part A) and encircled numbers and letters in alternating order (Part B). The test has two forms: the Child Form for ages 9 to 14 years and the Adult Form for ages 15 years and older. Practice exercises for Parts A and B are required (Strauss, et al., 2006).

Both Parts A and B require perceptual tracking of a sequence and speeded performance, but Part B also requires divided attention and mental flexibility. Because of this difference in cognitive test demands between Part A and Part B, it has been recommended that examiners calculate a Trails B – Trails A difference score (Lamberty, Putnam, Chatel, Beliauskas, & Adams, 1994) to capture a purer measure of divided attention and alternating sequencing tasks required in Part B. Scoring is expressed in terms of the time in seconds required for completion of each of the two parts of the test (Strauss, et al., 2006).

According to Strauss, et al. (2006), test-retest reliability is adequate in clinical groups, especially for Part B (r = .66 to .86) and ranges from .69 to .94 for Part A. Inter-rater reliability has been reported as .94 for Part A and .90 for Part B. Evidence from correlations between TMT, Part B and measures of speeded processing (i.e., Symbol Digit Modality Test and a variant of the Paced Serial Addition Test (PASAT) points to the TMT as a test of attention abilities, including visual search and visual-spatial sequencing or scanning abilities, as well as speed. It was also concluded that Part B is sensitive to cognitive flexibility, correlating strongly with the Wisconsin Card Sort Task, a set-switching task (Strauss, et al., 2006).

Memory

California Verbal Learning Test – Children's Version (CVLT-C; Delis, Kramer, Kaplan, & Ober, 1994)

The California Verbal Learning Test – Children's Version (CVLT-C) measures verbal learning and memory using a multiple trial list learning paradigm, and it can be administered to children and adolescents ages 5 to 16 years, 11 months. The CVLT-C requires the examinee to recall a word list over immediate and delayed memory trials

assessing free-recall, cued-recall, and recognition (Strauss, et al., 2006). Overall, the test takes 15 to 20 minutes to administer with an additional 20 minutes for the delayed-recall interval. Although the CVLT-C provides over 20 normed-based scores, for the purposes of this research, only the T score for Total Recall (List A, Trials 1-5) and Recognition Hits z score will be utilized.

The CVLT-C was normed on 920 children in 12 age groups, ranging from 5 to 16 years, 11 months of age, and was stratified based on 1998 U.S. Census data (Strauss, et al., 2006). The authors reported moderate to high internal consistency results, averaging .88 (split-half) and .85 (coefficient alpha) across the age spans (Delis, et al., 1994). The CVLT-C demonstrates high construct validity and correlates well with other child memory and learning tests such as the Children's Memory Scale (CMS; Cohen, 1997) and the Wide Range Assessment of Memory and Learning, Second Edition (WRAML-2; Sheslow & Adams, 2003). The CVLT-C has been used extensively with clinical and nonclinical samples of children (Delis, et al., 1994).

Visual-Spatial Constructional Ability

Rey Complex Figure Test (RCFT; Meyers and Meyers, 1996)

The Rey Complex Figure Test (RCFT) assesses visual-spatial constructional ability and visual-spatial memory in individuals 6 to 89 years of age. The test includes a copy trial, an immediate recall trial, a 45 minute delayed recall trial, and a recognition trial. Examiners are instructed to administer only non-visual tasks between the immediate and delayed recall trials. The RCFT takes approximately 45 minutes to administer, including a 45-minute delay interval. There is no warning of the memory component until the examinee is asked to recall the figure from memory during the immediate and delayed recall trials. Standard scores typically obtained include a copy score (a measure of visual-

constructional ability), immediate and delayed recall scores (which assess the amount of information retained over time), and the number of items correctly or incorrectly identified on the recognition trial (Strauss, et al., 2006). For the purpose of the current research, only the copy score will be utilized to assess visual-constructional ability since previous research has indicated youth diagnosed with Conduct Disorder tend to display greater visuoperceptual and visuospatial difficulties.

The RCFT was normed on 505 children and adolescents ages 6-17 years. Moderate convergent and discriminant validity of the RCFT as a measure of visual-spatial constructional ability (copy trial) and visual-spatial memory (immediate recall, delayed recall, and recognition trials) was demonstrated via intercorrelations between the RCFT and other measures in samples of both normal and brain-damaged subjects. It reliably discriminates between children with and without neurobehavioral and neurodevelopmental disorders (Strauss, et al., 2006).

Motor Function

Grooved Pegboard (Matthews and Klove, 1964)

The purpose of this test is to measure fine motor dexterity. Using the dominant hand first, the patient's task is to insert metal pegs as quickly as possible into slotted holes angled in different directions. A score is computed for each hand separately and is the time in seconds to completion (Strauss, et al., 2006). Although no test-retest reliability information is available for children, reliability coefficients are moderate to high (.67 to .86) in healthy individuals ages 15 years and older (Strauss, et al., 2006). The grooved pegboard task is moderately correlated with finger tapping (.35), has moderate to high associations with measures of attention (.31 to .46), perceptual speed (.60), and nonverbal reasoning (.34 to .45; Strauss, et al., 2006).

Data Analyses and Expected Results

DATA ANALYSES

The data includes multiple measures (i.e., IQ, executive functioning, attention, memory, language, and motor skills) across multiple groups (i.e., Conduct Disorder, childhood onset; Conduct Disorder, adolescent onset; Conduct Disorder, childhood onset comorbid with ADHD; Conduct Disorder, adolescent onset comorbid with ADHD; and ADHD). Because it is necessary to utilize a multivariate method of data analysis to control for experimentwise Type I error, descriptive discriminant analysis (DDA) will be utilized in the current study to determine group differences on these eleven measures. Sherry (2006) outlined the advantages of using DDA as compared to other analytic techniques. First, DDA is a statistical technique which provides a method of examining the degree to which multiple predictor variables are related to group membership using one statistical procedure. DDA can provide information about where groups differ on given variables contrasted to other multivariate techniques that require a primary analysis followed by post hoc tests. Initially, DDA will be utilized to determine which, if any, neuropsychological variables are most strongly associated with the Conduct Disorder, childhood-onset and the Conduct Disorder, adolescent-onset groups. If there is no statistical or practical discriminatory significance between the two Conduct Disorder groups, then the childhood- and adolescent-onset groups will be combined to form a Conduct Disorder group. A second DDA will compare Conduct Disorder (childhood- and adolescent-onset) with Conduct Disorder comorbid with ADHD.

Alternatively, if there are significant differences between the Conduct Disorder subtypes, each subtype group will remain intact. A second DDA will be conducted to determine which, if any, neuropsychological variables are most strongly associated with the five diagnostic groups (i.e., Conduct Disorder, childhood-onset; Conduct Disorder,

adolescent-onset; Conduct Disorder, childhood-onset comorbid with ADHD; Conduct Disorder, adolescent-onset comorbid with ADHD; and ADHD only).

RESEARCH QUESTIONS AND HYPOTHESES

Conduct Disorder is categorized into two subtypes based on the age of onset (American Psychiatric Association, 2000). It is expected that adolescents diagnosed with Conduct Disorder, childhood-onset subtype will demonstrate greater neuropsychological impairment than adolescents diagnosed with Conduct Disorder, adolescent-onset subtype as evidenced by a statistically significant separation between the two Conduct Disorder groups.

Research Question 1: When comparing the two subtypes of Conduct Disorder, will adolescents diagnosed with Conduct Disorder, childhood-onset demonstrate significant neuropsychological impairment as compared to adolescents diagnosed with Conduct Disorder, adolescent-onset? Specifically, will one or more of the seven neuropsychological measures significantly discriminate between the two groups?

Research Hypothesis 1a: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, Performance IQ scores (WASI, PIQ) will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1b: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, Verbal IQ (WASI, VIQ) scores will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1c: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, academic achievement scores in reading, numerical

operations, and spelling (WIAT-II-A) will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1d: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, executive functioning (CCT) scores will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1e: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, attention (TMT) scores will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1f: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, verbal memory recall and recognition (CVLT-C) scores will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1g: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, visual-spatial constructional ability (RCFT) scores will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Research Hypothesis 1h: For those inpatient adolescents diagnosed with Conduct Disorder, childhood-onset, scores of motor functioning (Grooved Pegboard) will be significantly lower as compared to scores obtained from adolescents diagnosed with Conduct Disorder, adolescent-onset.

Rationale 1: Evidence has revealed that adolescents with Conduct Disorder, childhood-onset exhibit verbal IQ deficits, impulsivity, attention problems, and neurodevelopmental difficulties (Hinshaw, 1994; Moffitt, 1993; Moffitt, Lynam, & Silva,

1994). In addition, Vermeiren, et al. (2002) has demonstrated that adolescents diagnosed with Conduct Disorder, childhood-onset had lower overall IQ, verbal IQ, performance IQ, and a number of deficits in attention, memory, and executive function as compared to adolescents diagnosed with Conduct Disorder, adolescent-onset subtype.

Research Question 2: When comparing adolescents diagnosed with Conduct Disorder to adolescents with a comorbid diagnosis of ADHD, will adolescents diagnosed with Conduct Disorder comorbid ADHD demonstrate a significant severity of neuropsychological impairment?

It is hypothesized that inpatient adolescents diagnosed with both Conduct Disorder, childhood-onset and ADHD will yield the lowest IQ, language, academic achievement, executive functioning, memory, and motor function scores as compared to all other adolescent groups.

Research Hypothesis 2a: For those inpatient adolescents diagnosed with both Conduct Disorder, childhood-onset and ADHD, scores on Performance IQ (WASI, PIQ), Verbal IQ (WASI, VIQ), academic achievement in reading, numerical operations, and spelling (WIAT-II-A), executive functioning (CCT), attention (TMT), verbal memory (CVLT-C), visual-spatial constructional ability (RCFT), and motor functioning (Grooved Pegboard) will be significantly lower as compared to scores obtained from all other adolescent diagnostic groups.

Research Hypothesis 2b: For those inpatient adolescents diagnosed with both Conduct Disorder, adolescent-onset and ADHD, scores on Performance IQ (WASI, PIQ), Verbal IQ (WASI, VIQ), academic achievement in reading, numerical operations, and spelling (WIAT-II-A), executive functioning (CCT), attention (TMT), verbal memory (CVLT-C), visual-spatial constructional ability (RCFT), and motor functioning (Grooved Pegboard) will be significantly lower as compared to scores obtained from the following

diagnostic groups: ADHD only, Conduct Disorder, childhood-onset only, and Conduct Disorder, adolescent-onset only.

Research Hypothesis 2c: For those inpatient adolescents diagnosed with only ADHD, academic achievement scores in reading, numerical operations, and spelling (WIAT-II-A), executive functioning (CCT), attention (TMT), verbal memory (CVLT-C), and motor functioning (Grooved Pegboard) will be significantly lower as compared to scores obtained from the Conduct Disorder, childhood-onset group and the Conduct Disorder, adolescent-onset group.

Researchers Nigg et al. (1998) have reported that adolescents diagnosed with only ADHD did not demonstrate verbal deficits as compared to adolescents diagnosed with both Conduct Disorder and ADHD.

Rationale 2: Previous researchers (Aronowitz, et al., 1994; Taylor, et al., 1996; Clark et al., 2000; Connor, et al., 2007) have reported the presence of ADHD typically signals a more severe form of Conduct Disorder with a chronic course and poor outcome. Individuals diagnosed with Conduct Disorder and ADHD are typically more impaired on neuropsychological measures of organization and executive function.

Overall, it is expected that the severity of neuropsychological impairment will proceed as follows among the five diagnostic groups: Conduct Disorder, childhood-onset with ADHD > Conduct Disorder, adolescent-onset with ADHD > ADHD only > Conduct Disorder, childhood-onset > Conduct Disorder, adolescent-onset.

DISCUSSION

Limitations

There are several limitations to this study. First, the research study only analyzed data collected post-hoc through a review of records from one residential treatment facility in central Texas. The treatment facility is known to admit patients who have not successfully completed other treatment programs due to the severity of their symptomatic behavior. It is possible that the researchers inadvertently obtained youth with extreme symptomatology and neuropsychological impairments. Findings may not be generalizable to other adolescents with similar diagnoses.

Furthermore, even though procedures called for patients to discontinue stimulant medication for a brief period of time prior to neuropsychological testing, it is possible that patients may have continued to take a variety of prescribed medications during the evaluation procedures. The psycho-pharmacological interventions may have impacted the results. Additionally, in cases where age of onset was not clearly identified in the diagnosis, clinical interview, or patient history, it was omitted from the study thereby reducing the sample size for evaluation. Lastly, the present study did not utilize an age-appropriate sample of adolescents (without mental health diagnoses) as a control group which limits the ability to accurately assess the severity of neuropsychological impairment.

Summary and Treatment Implications

The study investigated and compared the neuropsychological functioning in adolescents diagnosed with Conduct Disorder comorbid with ADHD who were hospitalized in a residential treatment facility between 2002 through 2007. The primary

goals of the study were to investigate, identify, and distinguish neuropsychological functioning differences depending upon age of onset, as well as investigate, identify, and distinguish neuropsychological functioning differences between adolescents diagnosed with Conduct Disorder compared to adolescents diagnosed with both Conduct Disorder and ADHD. Since previous research has indicated adolescents with Conduct Disorder, childhood-onset exhibit verbal IQ deficits, impulsivity, attention problems, and neurodevelopmental difficulties (Hinshaw, 1994; Moffitt, 1993; Moffitt, Lynam, & Silva, 1994), it is speculated that adolescents who were diagnosed with Conduct Disorder, childhood-onset subtype will have exhibited significantly more impairment on neuropsychological measures as compared to those adolescents diagnosed with Conduct Disorder, adolescent-onset subtype. Since individuals diagnosed with Conduct Disorder and ADHD typically have a more chronic course and poor outcome, and considering the research findings of Aronowitz, et al., 1994, Taylor, et al., 1996, Clark et al., 2000, and Connor, et al., 2007, it is also speculated that adolescents who were diagnosed with Conduct Disorder comorbid with ADHD will have more impairment on neuropsychological measures of organization and executive function.

Adolescents who are diagnosed with Conduct Disorder comorbid with ADHD often present challenges for their families, schools, communities, juvenile justice system, and treatment providers. The presence of ADHD symptoms often includes inattention, hyperactivity, restlessness, poor impulse control, and poor judgment. These symptoms increase the vulnerability for engaging in rule-breaking behaviors for the adolescent. In addition, boredom, increased risk-taking, and peer rejection may also serve as catalysts for rule-breaking and acting out behaviors which further solidify a Conduct Disorder diagnosis. The presence of both Conduct Disorder and ADHD complicate treatment interventions since the adolescent has developed behavior patterns that are often

reinforced by negative peers and provide internal stimulation and satisfaction. The earlier the onset of Conduct Disorder further complicates treatment interventions since the adolescent's behaviors have been reinforced for a consistent amount of time creating external reactions and emotional regulation that is solidified into their repertoire of problem-solving and self-soothing behaviors.

Speculating that the findings of the present research study will indicate that adolescents diagnosed with Conduct Disorder and ADHD and adolescents diagnosed with Conduct Disorder, childhood-onset will demonstrate significant neuropsychological impairment, it will be important for treatment providers to recognize and acknowledge the specific cognitive deficits these youth experience. Therefore, specialized treatment interventions need to be utilized with this population of adolescents, and treatment providers should be well-informed of the challenges when working with this specialized population. For example, adolescents diagnosed with Conduct Disorder and ADHD may require a special focus on social skills building with interventions that are clear, concrete, and simple. It will be important for treatment providers to rehearse these strategies during hypothetical situations that will allow the adolescent to not only verbalize his or her thoughts and feelings about the present situation, but also to practice how he or she would act. Placing the adolescent in a hypothetical, high-risk situation where he or she can role-play and begin to practice rule-compliant and healthy problem-solving skills may increase self-awareness and the ability to differentiate between his or her internal arousal, risk-taking fantasy, and recognize the consequences of illegal and disruptive behavior.

Golden and Golden (2001) suggest that adolescents with Conduct Disorder, childhood-onset may respond to treatment techniques that are often used with brain injured children. These children and adolescents often need a higher level of structure and predictability in their environment. In school, they would benefit from special attention,

which may include smaller classes and teachers specially trained to understand their learning difficulties. Since they are vulnerable to environmental influences, structure is necessary at home and at school to help them control their impulses. These children and adolescents generally learn better from experience than lectures or readings, further supporting the idea of role-plays and kinesthetic involvement during treatment interventions. By focusing on tasks that do not require strong verbal skills, these children and adolescents may succeed and gain an increase in self-esteem and self-confidence. An increase in self-esteem and self-confidence may provide the foundation for longstanding behavior change.

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